

Biopolymers and biohybrids for Electrochromic Devices, Batteries and Fuel Cells

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In the last few years, two approaches have been extensively proposed by the community of solid state electrochemistry to enhance the ionic conductivity and impart safety and economic benefits to polymer electrolytes (PE) for electrochemical devices, in particular batteries, electrochromic devices and fuel cells. One of the strategies adopted has been the production of new types of PEs based on natural polymers, such as proteins and polysaccharides, aiming at reducing the production cost and environmental pollution. The second strategy also embraced extensively has been to use ionic liquids (ILs).

The separator of a battery is a fundamental component placed between the electrodes which serves as a medium for the transfer of ions. Typically, the separator comprises a polymer membrane soaked in the electrolyte solution (e.g., a liquid electrolyte, a solvent or mixture of solvents or an IL, where the lithium salt is dissolved in).

In this framework green electrolytes composed of a polysaccharide [1] or a protein [2] or a biopolymer/siloxane hybrid were doped with an ionic salt and/or an IL and tested in electrochromic devices and fuel cells. Separators made of protein were developed and their performance tested in lithium ion batteries [3].

[1] S. C. Nunes, R. F. P. Pereira, N. Sousa, M. M. Silva, P. Almeida, F. M. L. Figueiredo, V. de Zea Bermudez, "Eco-friendly red seaweed-derived electrolytes for electrochemical devices", *Advanced Sustainable Systems*, (2017); DOI: 10.1002/adsu.201700070

[2] R. F. P. Pereira, F. Sentanin, A. Pawlicka, M. C. Gonçalves, M. M. Silva, V. de Zea Bermudez, "Smart windows prepared from Bombyx mori silk", *ChemElectroChem*, 3 (2016) 1084-1097

[3] R. F.P. Pereira, R. Brito-Pereira, R. Gonçalves, M. P. Silva, C. M. Costa, M. M. Silva, V. de Zea Bermudez, S. Lanceros-Méndez, submitted